

'PLAN, TRAIN, FLY'

# Success is in the details

by Catherine E. Borsché

To describe in infinite detail how the Mission Operations Directorate (MOD) prepares for a shuttle mission is a task that would require more pages than the average novel. Under the various divisions, massive coordination and teamwork takes place to orchestrate the “perfect” mission.

“The preparation is really the heart and soul of being able to execute the missions,” Phil Engelauf, chief of the Flight Director Office, said. “It’s the preflight preparation, knowing all of the ins and outs and the variations, that makes you smart enough to be able to respond in real time.”

For space shuttle missions, preparation begins about a year out.

“The standard thing is about a year before a mission, you get assigned, and that’s when you start working it,” Tony Ceccacci, lead shuttle flight director for STS-121, said. “From a year to three months prior to the flight you’re developing procedures, timelines and such. About three months prior to the flight you actually get to practice them and start doing all the simulations.”

A big part of the preparation involves writing the flight plans and flight rules.

“The lead flight directors in charge of the mission are responsible for all of the mission operations and preparation,” Engelauf said. “They oversee the development of the flight plans and the assembly and development of the flight rules that will be used to execute the mission.” Flight rules are predetermined decisions of what to do during a flight in regards to priorities, failure responses and more.

“We look at what are the specific objectives of this mission and the things that require special procedures, and we’ll write those and then do verification of (the procedures) in the simulator,” said Stan Schaefer, chief of the systems division in MOD.

Joint Operations Panel meetings are held regularly to cement the plans into place and go over any possible problems the mission could encounter.

“We talk about any issues that come up with regards to our mission timeline and the operations that we’re going to perform during the mission,” Rick LaBrode, lead International Space Station flight director for STS-121, said. “And we walk through the very, very fine details of the issues and come to a conclusion as to what we are going to do operations-wise in order to either avoid the problem or work around the problem.”

The Operations Division within MOD is instrumental in the planning phase of the mission.

“The Operations Division may begin preparing for a shuttle mission years before the mission, depending on the complexity,” Jim Clement, deputy of the Operations



Astronaut Terrence Wilcutt sits in the commander's seat in the flight deck of a shuttle mock-up in the motion-based simulator.

Division, said. “We play a significant role in the overall process of ‘plan, train and fly.’”

“The International Operations Branch provides a group of controllers (that works) to provide everything from systems experts to interpreters to technical documentation necessary to keep control centers around the world operating smoothly,” Clement said. “In the same branch, the Procedures Management Group manages the development, production and configuration management of the thousands of crew and ground procedures necessary for astronaut crews and Mission Control to safely operate the shuttle and station.”

The division is also involved in negotiating and producing integrated plans for flight crews onboard both the shuttle and station.

“Within the Cargo Integration Branch, our team works across discipline lines to make sure we can accomplish the objectives of the mission and solve problems within vehicle capability,” Clement said. And for space station assembly missions, the Design Integration Office performs operational design assessments in the strategic assembly timeline.

But it’s the simulations, actually putting all the procedures and rules to the test, that make up the core of the preparation.

The simulations take many forms, whether it is the entire mission team and management working in Mission Control and other planning rooms alongside the crew in the shuttle simulator, or the crew practicing spacewalks in the Neutral Buoyancy Lab or working in the Virtual

Reality Lab. The simulations also vary in time, length and intensity, although most are just over a particular flight day.

“We do have long sims,” Ceccacci said. “They used to go through the whole entire mission, but now that they can be 12 days long, we do them one day at a time. Sometimes we’ve had long sims, in which we’ve done three days at a time. In those all three teams get to support it, and we practice the various handovers and tasks required for the three different shifts.”

The simulations have also grown in scope over the last few years, including a major portion of several programs across the center.

“Since the *Columbia* accident, we’ve had requirements from the Mission Management Team to include them in some of our simulations,” Michael Collins, chief of Flight Design and Dynamics Division in MOD, said. “So the shuttle program and engineering and MOD people all participate in these major Mission Management Team situations, where the training team puts in malfunctions and we see how the entire team, including the astronauts and management, all respond to those problems.”

Simulations are critical in identifying potential flaws in the flight plan or within a team.

“We script simulations that will help exercise any weaknesses that we’ve identified in an individual crew (member) or in the crew and how they work together. So we will go exercise that and provide them feedback on how we think they’re doing,” Tom

Hanson, team lead in shuttle training division for Barrios Technology, Inc., said. “As we get closer to flight we’ll go through the integrated training, where we’re actually working with the flight control team that’s assigned to our flight.”

In the integrated training, another group of instructors enters the mix to evaluate the flight controllers themselves.

“They are looking at the chunks of the timeline that we’ve identified we’re going to train, and they’re looking for places where maybe we can throw the flight controllers a curveball and exercise them and get them ready,” Hanson said.

The practice “failures” are determined by the flight plan itself.

“They look at what things would be unexpected, or the (occurrences) that would have the biggest impact on the mission,” Schaefer said. “For example, if you’re getting ready to do a rendezvous and you lose some of your navigation equipment, how would you reconfigure the system so that you could continue with the rendezvous? Or would you have to break out and stop the rendezvous? A lot of those decisions are made in our flight rules, and so in a simulation they might put in a failure case to test out some of those flight rules or make sure that the person is going to make the right decision.”

Not only that, but simulations also help identify how all the teams work together, especially the crew and the flight controllers.

But all the coordination is worth it to the folks in MOD, who take pride in a mission’s success.

“I think we do a superb job. STS-114 went off flawlessly from our perspective, which is just a great testament to the individuals, the flight controllers and the training team, because it had been so long since we had flown,” Schaefer said. “There were a number of new people who either didn’t have a lot of flight experience or had none, and they performed like they had been doing this forever.”

It is MOD’s aim to make the mission so seamless that the crew is fully able to complete the mission objectives.

“We really are an extension of the crew onboard, and we do a lot of things so that they don’t have to,” Schaefer said, “so they can focus on the reasons why they’re there in space.”

Astronauts train to dock the space shuttle to the International Space Station in a planetarium-like simulator at the Johnson Space Center.

NASA/Ebair JSC2002-00001

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*Astronaut Eileen M. Collins, STS-114 commander, dons a training version of the shuttle launch and entry suit prior to the start of a mission training session in the Neutral Buoyancy Laboratory near Johnson Space Center.*

NASA/Stafford JSC2004E41381



NASA S114E7188



NASA/Markowitz JSC2004E0407



NASA/Markowitz/Blair/Sanchez JSC2005E39902

# Curtain call for astronaut Eileen Collins

by Catherine E. Borsché

*An inspiration to little girls everywhere, astronaut Eileen Collins leaves NASA having given the space program a much richer history. With her departure, she offers advice for those embarking on their own amazing life journeys.*

“Find something that you really love doing, something where you feel you are making a contribution. Learn as much as you can, be as smart as you can, find a niche,” Collins said. “If you find something you can do, take charge—fill the void.”

Collins said that, “if you don’t love what you are doing, you will give it up. I love to fly. I’m an astronaut and I’m a mother. Those are the two things that give me energy. I’m excited about getting my kids up and training.”

Collins exits this chapter in her life to glowing reviews from NASA leaders.

“Eileen is a true pioneer in space and on Earth,” Mike Coats, director of Johnson Space Center, said. “Her service and dedication to her country, to NASA and to space exploration are an inspiration. She meets every challenge with confidence and an ever-present smile.”

Collins is not one that could be fit into a preexisting mold. Her career with the Air Force and NASA was truly revolutionary.

In 1979, Collins graduated from Air Force Undergraduate Pilot Training at Vance Air Force Base in Oklahoma, where she was a T-38 instructor pilot until 1982. From 1983 to 1985, she was a C-141 aircraft commander and instructor pilot at Travis Air Force Base in California. During her service with the Air Force, she was an assistant professor of mathematics and a T-41 instructor pilot. Collins was selected for the astronaut program while attending Air Force Test Pilot School.

Collins became a member of the elite astronaut corps in July 1991, where she served as, among other things, a Mission Control spacecraft communicator (CAPCOM), an Astronaut Office Spacecraft Systems Branch chief, a chief information officer, a shuttle branch chief and an Astronaut Safety Branch chief.

In between her various desk duties, she also managed to forge new ground as the first woman to pilot the space shuttle (STS-63, *Discovery*) and the first woman shuttle commander (STS-93, *Columbia*).

“Eileen Collins is a living, breathing example of the best that our nation has to offer,” said NASA Administrator Michael Griffin. “She is, of course, a brave, superb pilot and a magnificent crew commander. Beyond those qualities, she is both very bright and modestly self-effacing about that fact. And above all, she is possessed of a quiet determination to attain the very highest levels of accomplishment. I am proud to know her and will greatly miss her at NASA.”

Collins participated in four spaceflight missions, two as pilot and two as commander. She also commanded the STS-114 Return to Flight mission aboard *Discovery*, where she and her crew tested and evaluated new procedures for flight safety and shuttle inspection and repair techniques.

The two-week, 5.8-million-mile journey in space would be her last, though, as she announced her departure from NASA on May 1. With her exit she plans to pursue private interests and spend more time with her family.

“I have been at NASA for 15-and-a-half years. It’s time for me to step aside and give the other astronauts a chance to fly,” Collins said. “It’s important that our country has a larger number of people with experience in space.”

Collins will be sorely missed by those who have had a chance to work with her and see her professionalism in action.

“Eileen is a gifted leader who knows what it takes to get a team through the most difficult of times,” Flight Crew Operations Director Ken Bowersox said. “All of us will feel Eileen’s absence, but regardless of the path she pursues after leaving NASA, I know she will continue to exert a positive influence on the explorers of today and tomorrow.”

Collins is appreciative of her many years within the NASA family.

“I have greatly enjoyed all of the various jobs I have had in the Astronaut Office; most specifically, I have enjoyed working with our superb NASA and contractor employees,” Collins said. “The people I work with are the finest professionals. These are people who love spaceflight and love being a part of exploration.”

Collins hopes her amazing journey is not the last as NASA reaches further into the solar system.

“I hope to continue to work in the aerospace industry in some capacity. I leave the astronaut job with great memories, but also great expectations for our country’s future in space!” Collins said. “Per NASA’s current plan, people will again walk on the moon, and my dream is to someday see astronauts from the United States living on Mars.”

That would be a fitting tribute for a woman whose legacy will always endure within the NASA family and beyond.